

SIXPENCE

NOVEMBER 1943

AMATEUR RADIOS

THE
OFFICIAL ORGAN
OF THE
WIRELESS INSTITUTE
OF
AUSTRALIA



Published by the Victorian Division

AMATEUR-RADIO

INCORPORATING THE N.S.W. DIVISIONAL BULLETIN

Vol.11. No.11

November 1943.

VACUUM TUBE VOLTMETERS

... By Alex Clyne VK3VX ...

These articles have been written with a view to bringing together under one heading a complete summary of the main Vacuum Tube Voltmeter types, together with their respective characteristics, a subject which is dismissed in a column or so in most text books and amateur Handbooks.

Part I.

V.T.V.M. Types and Characteristics

....

The need for a V.T.V.M. usually arises from one or both of the following:-

(a) The measurement of voltages appearing across high impedances calls for a measuring device which draws little or no power. A Conventional voltmeter consisting of a milliammeter with a resistance in series for a multiplier may, when applied across a similar resistance, introduce an error of up to 50%. Corrections may be made for this loading effect, but such a procedure precludes the taking of rapid readings, as may be desirable in, say, checking over a receiver.

(B) AC measurements may be made with moving iron and oxide rectifier meters but these instruments are restricted to low frequencies.

For the purpose of this survey we will divide V.T.V.Meters into two classes:-

1. Those introducing heavy loading.
2. Those introducing light loading.

However, before going into details of the various types it is necessary that certain definitions be clearly understood, and as these same definitions seem to be beneath the contempt of the writers of most text books and amateur radio manuals, there is all the more reason for including them here.

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SQUARE LAW...means that the rectified current is proportional to the square of the applied AC voltage.

LINEAR...implies that the rectified current is directly proportional to the applied AC voltage. Both of these arise from the characteristic shape of the plate current versus applied voltage (grid voltage in the case of a triode etc.) curve. All tubes have a square law characteristic at low values of applied voltage, while most types become practically linear at higher voltages.

PEAK READING...a VTVM is said to be peak reading when the reading of the DC meter is proportional to the peak value of the applied AC voltage. IRRESPECTIVE OF WAVE FORM.

AVERAGE READING...when the DC meter reading is proportional to the average value of the applied AC voltage whatever the wave form.

R.M.S. READING...when the DC meter reading is proportional to the R.M.S. value of the applied AC voltage, again irrespective of wave form.

NOTE...and this is an important point...that any VTVM may have the scale of the DC meter calibrated to read directly all three values...peak, average and RMS...of say sine wave AC voltages; but if a voltage of a direct wave form be applied only one of the scales will be correct, according to whether the particular type of VTVM is peak, average or RMS reading.

Having these points well in mind, we may now have a look at the various VTVM types.

1. HEAVY LOADING TYPES.

a. DIODE WITH SERIES RESISTOR...The fundamental circuit arrangement of a series resistance loaded diode VTVM is shown in Fig. 2. It consists solely of a diode rectifier, with a series load resistance R , and a current meter M .

When a DC voltage sufficiently large to operate the diode on the linear part of the curve (above about 10 volts) is applied the current through the circuit is approximately $E \times R$ since the resistance of the diode is very small compared with R , hence for DC the VTVM functions simply as a milliammeter with a multiplier, and has no advantage over the conventional meter. A possible exception is that the diode can protect

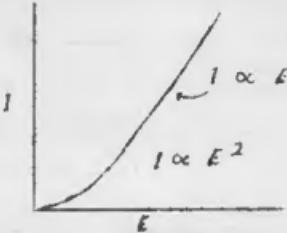


FIG 1

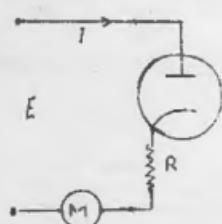


FIG 2

the DC motor against overload and against reversed polarity. A similar state of affairs exists when AC is applied, but of course the diode then acts in its true capacity as a rectifier.

As there is no capacitance included in the circuit the rectified current varies in proportion to the instantaneous value of the applied AC voltage, and when the varying DC current is passed through a DC motor, the latter indicates the average value of this current, being in itself unable to follow the rapid fluctuations.

The series resistance loaded diode V.T.V.M. is therefore an AVERAGE READING instrument. It should be noted however, that at very high frequencies it tends to become peak reading, due to stray capacities tending to hold the rectified current at peak value.

At very low values of applied voltage (below about 1 volt) the response is square law and the instrument tends to become R.M.S. reading. The linearity may be improved by using a very high value of load resistance, but this necessitates the use of a more sensitive and therefore more expensive D.C. meter.

B. DIODE WITH SHUNT RESISTOR... This type which is shown in Fig. 3 is peak reading due to the presence of the condenser C in the circuit, but like the previous type tends toward R.M.S. reading at low voltages. It cannot be used for DC measurements as with C shorted out and DC applied to the terminals the diode becomes practically a dead short.

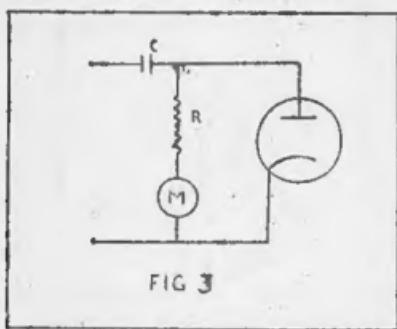


FIG 3

On each positive half cycle, when AC is applied, C charges up, and during each negative half cycle it discharges through R and the external circuit, therefore the instrument is not perfectly peak reading; the current through the motor averages somewhat below the peak value.

In both resistance loaded diode VT Voltmeters the comparatively heavy current drawn during the positive half cycle produces a substantial load on the external circuit, the average loading being about half that of the equivalent DC meter of conventional type.

The frequency range of both resistance loaded diode types is very good. The low frequency limit of (a) is zero (i.e. DC) while that of (b) is determined by the time constant of C in combination with R. At the lowest frequency to be applied $R \text{ (meg)} \times C \text{ (mmfd)}$ $\times f$ (cycles per second) should be greater than 100.

The electron transit time sets the high frequency limit in both types. At high frequencies the error per cent may be expressed as

approximately:-

$$10 \frac{Fd}{\sqrt{E}} \quad \text{where } d = \text{plate-cathode spacing cms}$$

E = applied voltage

Where loading is not important these types are very convenient since only filament supply is required and a very compact unit may be constructed.

An indication of the high frequency limits, the following are the approximate maximum frequencies at which various tubes may be used with an error of 5%:-

Standard receiving tubes ... 7 Mc/s

Acorn receiving tubes ... 20 Mc/s

Special instrument diodes ... 100 Mc/s (will give approx. measurements up to 1000 Mc/s)

c. GRID RECTIFIER... This V.T.V.M. consists of the familiar grid leak detector with a DC meter in the plate circuit. When AC is applied across the terminals rectification takes place in the grid circuit, the grid and cathode acting as a diode; the rectified current flows through R and increases the bias reducing the plate current and providing an indication on the DC motor M.

This type is normally backward reading, but by means of a suitable balancing circuit M can be made to read forward. This will be treated in Part 2.

If the applied voltage is large, rectification may take place in the plate circuit as well as in the grid circuit. Grid rectification produces a drop in the plate current, while plate rectification produces a rise, consequently a mixture of two lowers the sensitivity of the instrument.

The mixture of grid and plate rectification is always present in some degree and therefore it is difficult to calculate circuit values for any given voltage range. R is usually determined experimentally and C may then be calculated from RCF 100 as for the shunt diode.

DC voltages may be read by shorting C. It is important to see that the grid does not go positive as this may result in damage to the tube. Calibration is unstable and frequent recalibration is necessary if accuracy is required.

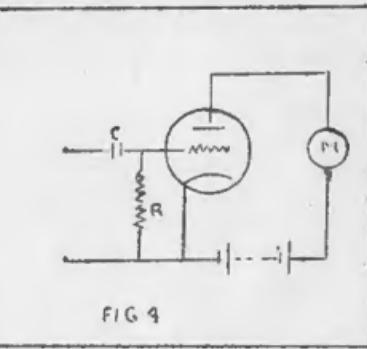


FIG 4

This type is peak reading, like the shunt diode, and the same remarks apply as for the shunt diode in respect to loading, accuracy and frequency limits. The sole advantage over the shunt diode lies in the increased sensitivity.

2. LIGHT LOADING TYPES.

(a) CAPACITY LOADED DIODE...NOTE...This type is often called the Peak Diode VTVM; but to avoid confusion with the Shunt Diode VTVM we will refer to it here by the above name.

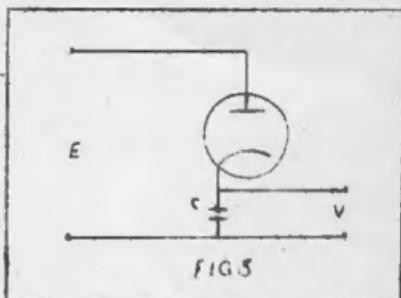
One of the simplest and most convenient methods of measuring AC voltages, particularly at high frequencies is to measure the voltage across a condenser charged through a diode as in Fig. 5.

When AC is applied the first positive half cycle is rectified by the diode and charges the condenser to a potential V which in the ideal case is equal to the peak value of E .

Provided that the losses are zero, the condenser then remains charged during all subsequent cycles, and therefore no current is drawn after the first positive half cycle, the instrument then has effectively an infinite input impedance. In practice the input impedance is limited by the insulation resistances between the input terminals and across the diode and the condenser, but these may be made very high.

C should be large compared to the diode capacitance so that all the alternating voltage appears across the diode. A value of C greater than 100 times the capacity of the diode is suitable; but should not be made too large, and then the charging current may damage the diode or at least considerably shorten its life.

The voltage V may be read by means of an electrostatic voltmeter, and the input impedance may be kept high by this means, but the instrument will not follow variations in the applied voltage, due to C holding its charge for comparatively long periods. For this reason a resistance of the order of 10-50 megohms is often connected across the condenser. This allows the condenser to discharge more rapidly; but if the resistance is too small the voltage V will fall below the peak value of E and



readings will be in error. (Note that this is no disadvantage if the meter be always used for measuring voltages of the same waveform with which it has been calibrated. However the input impedance will be lowered.)

As electrostatic voltmeters are necessarily delicate and expensive it is more usual to apply V to the grid of a DC amplifier and measure the change in plate current of the latter.

This is almost the ideal in VT Voltmeters, having very high input resistance, good accuracy, and a frequency range restricted only by the same factors as mentioned before for other types of diode VTVM.

(b) PLATE RECTIFIERS... These may be sub-divided into two types:-

- (1) Square Law
- (2) Reflex or Linear

Both are simple plate detectors with a motor in the plate circuit the difference lies in the relation between the change in plate current with change in applied grid voltage.

In the square law type use is made of the Square Law Characteristic to produce a VTVM which is RMS reading, an advantage in some applications.

The RMS calibration holds only at low input voltages, however at higher voltages the characteristic becomes linear and the instrument tends to peak reading. This type is not widely used, the reflex type being generally preferred.

In the reflex arrangement (Fig. 7) the whole of the load resistance is placed in the cathode circuit, and it is then common to both the plate and grid circuits back.

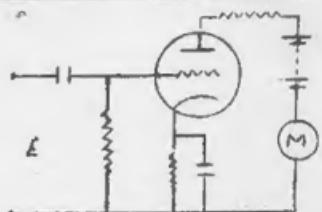


FIG 6

The effect of negative feedback is to make the change in plate current approximately proportional to the change in applied grid voltage, over the whole range, thus producing a linear scale which tends to reduce the visual error in reading at the low end of the scale.

The sensitivity depends solely on the value of R, therefore quite large variations in tube characteristics and/or supply voltages may be tolerated.

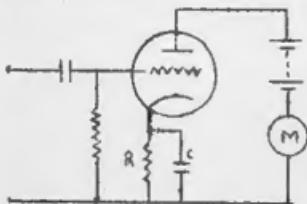


FIG 7

Furthermore range changing is simple, as a switch may be used to insert various values of R in the circuit. The instrument may be made peak reading as shown, or average reading by omitting C.

When C is used its size should be such that the time constant of the CR combination is suitable (R meg \times C mfd \times f cycles/sec greater than 100) as otherwise the DC voltage across C will be lower than the peak value of E, as in the Capacity Loaded Diode and the reading will be in error.

However if C is too large the charging time will be too long and the meter will not follow variations in applied voltage. Therefore it is usually necessary to change C when R is changed.

The Reflex VTVM has the advantages of linearity, stability of calibration, high input resistance and flexibility, while the accuracy is generally good.

In Part 2 to be published next month, Mr. Clyne will discuss Slide-Back VT Voltmeters, Magic Eye Indicators, D.C. Amplifiers and Balancing Circuits.

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NEW RECORDING CHARACTERISTIC

The following are some details of a new recording characteristic, the use of which is claimed to give a considerable reduction in noise level.

The frequency characteristic in general use for disc recording is the "so-called" "Constant velocity," in which the amplitude of cut is inversely proportional to the frequency above the cross over point (which varies between 250 and 800 c/s) below which a constant amplitude characteristic is used; i.e. the amplitude of cut remains constant and independent of frequency with reference to a given input.

A system of pre-emphasis and compensation with what has been termed the "orthacooustic characteristic" has recently been developed, which increases the recorded level of part of the low frequency range, and all frequencies above the cross over point. This technique is based upon the frequency-energy analysis of speech and music which indicates that low and high frequency parts of the audio spectrum normally contain a lower energy level than the portion between 100 and 500 c/s.

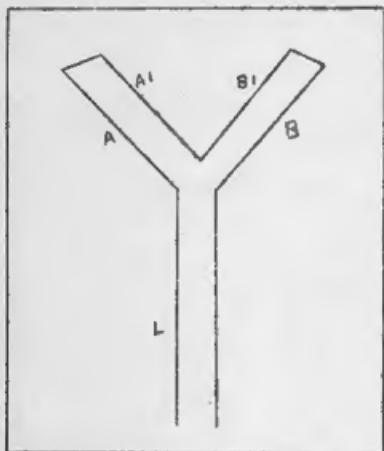
This research led to the realisation that both low and high ends of the spectrum could be increased in amplitude on a recording without danger of over-cutting at the low end and without producing too steep a waveform for accurate cutting and playback needle tracking at the high frequency end. Recording these low and high frequencies at higher than normal levels and

(Continued on page 8)

A NON-DIRECTIONAL DIPOLE

The normal radiation pattern of a horizontal dipole is approximately a figure-of-eight for horizontally polarised waves.

To obtain non-directional qualities the arrangement as shown in the diagram has been devised. It consists of two "double" quarter wave limbs A, Al and B, Bl set at an angle of 90 degrees to each other and connected directly to a two wire transmission line L.



The response of such an aerial was found to be substantially circular, i.e. non-directional in the horizontal plane. The wires Al and Bl may be made thicker than the other wires in order to better match their impedance to the line. The distance between the wires A and Al or between B and Bl should be a very small fraction of the working wavelength. The two outer ends of each pair of wires are connected together so that although the currents flowing through them are in opposite directions along the wires (owing to phase reversal at the closed ends) the currents flow in the same direction in space. In other words the radiation effect is the same as if each pair of double wires were replaced by a single wire.

.....XXXXXX.....

RE-JUVENATION ELECTROLYTIC CONDENSERS

Mr. Sid Clark sends us through Jim Corbin ZYC, further information about re-juvenating electrolytic condensers.

To put them back into service he used to carefully remove the top seal, then added distilled water to make up for the loss of solution. After enough time has elapsed to allow the solid to dissolve the seal was replaced. They can also be reconditioned by cleaning out and refilled with a saturated solution of Borax and water.

New Recording Characteristic.

reproducing them at correspondingly lower levels, so that the net result is the same as though no pre-emphasis had been used, makes possible a reduction in the noise level of the system.

SLOUCH HATS and FORAGE CAPS.

(Send in your Christmas 73s for your friends)

This, as I am always telling you all, is your column. Well, how about you chaps writing it for the December, and if you can, January issues. The idea is this. Christmas Cards etc. are scarce at forward area stations and many of you will wish you could send your 73s to those hams all over VK, you used to work...just how long ago?? So we offer you your column, to send your Christmas 73s either collectively if there are a lot of you together, or individually, to those VKs you used to QSO who may now be in VK6 while you are in VK9. Schop to it chaps, AIR MAIL just about goes everywhere so use it to send your 73s together with your address to all your Ham friends and they will read it in your column. Oh, yes, they'll see it...it is marvellous how widely Amateur Radio travels these days. So oms, AIR MAIL it at once to your Div HQ, Fed HQ or ZMC.

Another idea...when you pay your subs this year. How about using the back of the account form to scribble a few notes on. Your divisional Secretary will QSP them on to me. Just a few lines will do (more, of course will do better) telling where you are, where you've been and all the hams you have seen. So oms don't forget when the Sub. account arrives.

What do you know, Charlie Miller after all these years is now a Sergeant. Fb, Charlie om, they must have noticed that you were in the R.A.A.F. at last. Let's hope they remember you when they are handing out the Pilot Officers, etc. etc.

Now I'm a bit worried about VK2ALG's Moustachoes...saw a lad t'other day and says he, what's this about John Ollie. He hasn't got a big Mo...smatter of fact, I reckon he looks a bit like Clark Gable!!! I say Joo, is that what you meant, where his resemblance to you comes in?????. From the way this is shaping I will need a police guard very soon. Hi! (ZMC)

Did you know Vaughan Marshall was a Group Captain these days? Not so bad for a Ham, you know....only about two more rungs left on the ladder now, isn't there Vaughan, before reaching what one would call Olympian Heights. Hi!

VK5JT Joe Kilgariff is still Fl/Sgt at Adelaide W/T Station and seems to see some of the VK5 gang on and off. Mentions that he had heard from Clario Castle 5KL who has bee n 15 months up in the R.A.F around Darwin...5KL is now a Corporal these days.

Saw Ray Deano 5RD a month or so ago. He spent a lot of time up North but is now at Mallala wearing R.A.F Flight Sargeant insignia.

VK5LD Launce Deane, now a Fl/Loot is also somewhere up North. Also up there is F/O Allan Heath, better known as VK5ZX.

From the "Melbourne Herald" of 6/10/43 we learn that Mr. & Mrs. Tinkler VK2ZV, who has been missing since the fall of Singapore, stating that he is fit and being well treated. The card is undated. Incidentally, while on this question, Bill Moore's Mother also received a card from VK2HZ, and this one seemed to consist of phrases like the ZMC cables-AWA sent overseas.

From Lance Corporal Jim Watson VK3K, who is with a Signal Training Battalion at Bonegalla, we learn that Dick Carter VK3GC was one of the few survivors from the Hospital Ship "Centaur."

Johnny Trell 2X is not now dealing with postings in an official capacity so who knows, he may post me those long promised notes!!!

VK2OR has reached the rank of Sqd/Ltr and is at present sojourning in England...firing out the "hows and the whys" I guess.

We don't hear very much of the Silent Service, but another of the members of the Victorian Division who has been serving since the outbreak of war is Jim Kerley. Jim was a member of the 200 metre allocation Committee for a number of years. No information is to hand of where he is, or has been serving. Jim holds the rank of Petty Officer R.A.N.V.R.

V3VE Sergeant Bill Williams has a new second op. - a son, whom we understand has been named Keith in honour of Keith Scott VK3SS who is reported to be nearly as proud as Bill. Hi!

P/O Jack Howes is somewhere up North and seems to retain his sense of humour in spite of the heat. Listen to this "Sometimes the 'honourable gentleman' drop in for a social call occasionally and usually leave .. present or two, and sometimes, we insist upon them staying with us...there are some of them doin' the road in a peacock...nice people." You will do, Jack. Hi

Jack Pitterson is holidaying up around Cape York where all SU DX pounds in RD all day. He has unfortunately only met three "hams" up there and those chaps ran around on four legs an' snorted (much the same as high power fence boys...chap must be a C'Mer...2VG). At the time these hams were a welcome addition to the crew which had been of the tinny variety for a couple of months.

VK3UC Pilot Officer Doug. Norman is to be congratulated upon receiving his Commission. Doug is now attached to Southport Area HQ after service in N.W. Guinea where he earned a "Mentioned in despatches" last year.

Over among the VK6's in VK3PK Sgt. Fred Smith who is instructing at a Signal School at Narragun, W.A. Fred advises he is enjoying himself and putting on weight.

From VK3AH who uses that "distance covering AF07I" and is, I think, way up Nth. We're told, reports the following among the RAAF in his area. Fl/Lt. Ron Struter 3MC, Rev Graf VK3CT, Sgt. Adrian Miller VK3AH, Tom Ham (a real "ham") VK3UX, and VK6FH who is a Fl/Lt.

By the way does anybody ever hear of any VK7's anywhere around the place. I heard some time ago that Jack Batchelor 7JB was reported as living, being accidentally discovered in Central Australia, but other than that I rarely seem to mention them in this column.

Bruce Chapman VK2BN/VR4BA a Lt. in the Nav is now reported to be having a quiet life down South after a long spell of duty in Northern waters. But after his long sojourn in the Solomons before the War Bruce should be able to take it up North.

I believe that Rex Cawthon 2VG and Bill Lewis 2YB/JXF have both recently got their Commissions with the R.A.A.F...for gods sake.

VK3KP Capt. Dennis Ayre of an AIF Wireless Section in New Guinea in sending greetings to the boys advises that he is feeling pretty

(Continued on Page 14)

... DIVISIONAL NOTES ...

- FEDERAL HEADQUARTERS -

Upon receipt of a letter from C. H.L. all Division's were circularised and informed of this coming function, and requested to forward a selection of cards for transmission to China. The States will be with a will for a splendid assortment of cards should grace the walls of the Convention Hall on 1st January 1944. During the greatest number of calls were received from V.T. and W.L. who gave a word of praise for his selection. These consisted of quite a few "A's" and "B's" whilst appreciating the motto behind the offer the Executive felt it at this really couldn't forward treasures like those on to Jane's list.

W.F.U. SOUTH WALES DIVISION

The October General Meeting of the Division was held at A.C.A. Buildings, Pitt Street Sydney, and boy, what a meeting it was. Among those present were Squadron Leader Arthur J. Bell (R.A.F.) G.D.F/VL2Z, Sergeant Joe Trichy J.A.B. Flight "Loot" Basil Dale VK-KX/UX, Frank O'Neil ZL4CD, Jim Strahan ZJAAF, Flight "Loot" Len Chisol VL2LC ditto G. Tilbrook VL5G, Lieutenant Joe McElrea V.J.C and to cap it all Signaller Dave Foran who first received a site from the radio lug when he joined the A.I.F. and only three weeks ago sat for his ticket.

Each visitor was asked to say a few words and the first to start the ball rolling was G.D.F who told of his experiences in various parts of the world including VR2. Incidentally Arthur is one of the "most human" G's that we have met to date. If it were possible I would have liked to print ZL4CD's fighting speech with reference to post war ham radio and those people who adopt a negative attitude regarding the holding of our bands. Well spoken, J.M. Too bad you must go back to the land of the "Shires", we could use you out here. Also, we would like to tell the gang the story of the ham who overlooked a certain enemy airstrip and sent back vital information on to? That will have to keep until the war ends. Joe McElrea told us the story of the greaveine and how it operates between Darwin, Alice Springs and Sydney. You know these A.I.F. must have something akin to the ham spirit. Whatsa, R.D.G?

All in all these chaps proved themselves real hams from the Squadron back down. Each and every one has managed to 'nug' for something that will help the post war rig!

The ballot for the election of the Federal Executive for 1943-45 was declared and resulted as follows:-

Federal President	F.P. Dickson	VK2AFB	(unopposed)
Fed. Vice President	H.P. Peterson	VK2dP	
Federal Secretary	W.C. Ryan	VK2T1	(unopposed)
Executives	C. Fryar	VK2NP	
	W.J. McElrea	VK2UV	

The next Meeting of the Division will be held on Thursday 18th November, and all Amateurs are invited to be present. By the way - a few chaps have been confused by the Y.M.C.A. Notice Board showing the W.-A. Meeting as commencing at 6 p.m. Three meetings are held on Thursday night. 6.p.m. Federal Executive. 7 p.m. State Council; 8 p.m. General Meeting. Hope this clears up a little misunderstanding.

EMERGENCY COMMUNICATION NETWORK

Since the last batch of notes appeared, considerable progress has been made towards re-organising the Network to fit in with N.E.S. requirements. The Director of National Emergency Services has formally constituted the N.E.S. Wireless Committee and this body consists of Messrs. Wetherill (R.I.'s Dept.) Sergeant J. Raynor (Police Radio) R. Priddle and W. G. Ryan (W.I.A) under the Chairmanship of the State Operational Controller Colonel F. Lorenzo D.S.O. with Mr. H. Crosky of N.E.S. as Secretary.

This Committee, which is to act in advisory capacity, meets each month and at its first meeting made the following appointments:-- Deputy Controller, Wireless N.E.S. W.G. Ryan VK2TI, Technical Officer Wireless, F. P. Dickson VK2AFB, Wireless Training Officer C. Fryar VK2NP. These are key positions in the Network, the Deputy Controller being directly in charge of Emergency Wireless Communications whilst the other two positions are self explanatory. This is quite a feather in the Institute's cap and all Members will doubtless be proud of the honor paid these officers.

In order to give Radio Operators an insight into the workings of the various District Controls to which they are attached a series of visits of inspection have been arranged to the various Centres. When these inspections have been completed all Operators will visit both State and Metropolitan Controls and thus when they either have to send a message or receive one they will be able to picture just what is behind it all. The message will not be a dozen words or so scrawled on a piece of paper. They will have a definite knowledge of the meaning of the message.

Stations are now using a very much revised procedure. This new method of handling messages has been acclaimed by all operators but at the time of writing a few rough edges still remain to be rubbed off.

With the introduction of the new method of traffic handling it was decided to curtail the October exercises for the Cup to three week-ends and as a result VL2JL succeeded in gaining 147 points out of a possible 150. VL2JK was a close second with 146 and VL2JC third with 145. This is very close scoring indeed. From a perusal of the scores listed below you will see that 7 points covered the first seven stations!

Here are the scores:-

VL2JL	147	VL2JP	140	VL2JG	136
VL2JK	146	VL2JJ	140	VL2JF	121
VL2JC	145	VL2JN	140	VL2JE	88
VL2JM	143				

Now that three series of Exercises have been completed, I think that all Members of the Institute would appreciate it quite a lot if the three months scores were given. Here they are:-

AUGUST	SEPTEMBER	OCTOBER			
VL2JJ	188	VL2JC	195	VL2JL	147
VL2JG	184	VL2JL	195	VL2JK	146
VL2JP	180	VL2JP	187	VL2JC	145
VL2JC	178	VL2JG	186	VL2JM	143
VL2JK	172	VL2JJ	185	VL2JP	140
VL2JF	165	VL2JL	183	VL2JJ	140
VL2JL	149	VL2JF	182	VL2JN	140
VL2JE	82	VL2JF	182	VL2JG	136
VL2JN	48	VL2JE	153	VL2JF	121
VL2JM	nil	VL2JN		VL2JE	88

From these figures you will see that VL2JL has established a slight with a first and an equal first, but against that he was way down in seventh place in August. VL2JJ has a first place, a fifth and a sixth, but now they've also a new 25 mmfd condenser to waitch out. VL2JC has an equal first, a fourth and a third. If you any of you chaps can pick the ultimate winner you're pretty good!

VL2JL.. Again congratulations chaps. I'll bet you needed a new size in hats one Sunday morning a few weeks ago. How do you like the new phonetics. Too bad we haven't a VL2JQ isn't it!

VL2JK.. Well done you lads. Yours was a particularly fine performance. There is only one ham attached to this station and during two out of the three week-ends he was away off duty. Ken and Charlie did a real good job and should develop into real good hams when its all over. By the way Ken I wonder if 2JL heard you trying out the new relay? You're very lucky Erm in having such keen helpers.

VL2JC.. Slipped back a little this month. Gordon my boy you can't afford to slack up for a minute or else the wolves are hard on your trail. How are the "V" Beams om? Can you fold them yet? Better luck next time.

VL2JM.. Operated by our new Federal President did quite a good job. Perce has all the resources of the A.G.L. Go behind him so watch out for the new aerial. By the way Perce how's Felix and family?

VL2JP.. Dropped back a couple of places this time. Of course, when a fellow goes on a honeymoon anything is likely to happen in more ways than one. Better luck next time om.

VL2JJ..A dark horse for next round. Found out their trouble at last. By the way Arthur, hope that fifth anniversary was all that you hoped it would be.

VL2JN..Well done Len Blackett. Too bad everyone isn't as keen as you.
VL2JG..This station is rather a disappointment dropping from second place in August to seventh place in October. What's happened to that signal Jeff?

VL2JE..Thanks a lot Jim. The manner in which you "stick" is very much appreciated. Too bad you had to miss that inspection at Artarmon.

VL2JF..Still plodding along. Perce Rooney will soon be Chief Relay Officer. Doing a good job 'em.

... VICTORIAN DIVISION ...

We were very pleased to welcome to the last meeting two interstate visitors in the persons of Captain D. B. Knock 2NO and Lieutenant J. Ackerman 2ALG.

Captain Knock being asked to speak said he was very pleased to be present and congratulated those, not only in this division but other Divisions, who remained in civilian life, on their wonderful efforts in carrying on the Institute, for he visualised that after the war the Institute would expand enormously. "Amateur Radio" he said was eagerly looked forward to by members of the defence forces as though it were wable in some measure to follow the movements of fellow Homo.

Lieutenant Ackerman gave a short talk of his three years on active service some of the time being the Units official photographer. All being well he hopes to be at the next meeting when he will give an illustrated talk. You had better turn up chaps its sure to be good. The night is Tuesday December 7th.

Stan Skinner turned up at the meeting proudly displaying a brand new A.O.P. Certificate which he had obtained at the recent examination. Congrats OM.

A new feature to commence in the next issue December will be a page of review of Technical Books. An arrangement has been made by the Review Editor Mr. A. Clyne, VK3VX to obtain books from McGill's for this purpose.

SLOUCH HATS AND FORAGE CAPS -

Good himself. He recently sent out an SOS for a bug key via 3JO who was able to put him on to the right man.

And now in conclusion, don't forget those Christmas and New Year 73s to all your old VK friends....use the AIR MAIL....and QSP them to either your Divisional Sec or to Jim Corbin 2NC, 78 Maloney St., Eastlakes Mascot.

We regret a mistake in the last paragraph on page 9. It should have read - "Mr. and Mrs. Tinkler have received a card from their son F/O Arthur Tickler"Ed.

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